09/08/98

JC614 U.S. PTO

A | PROV

JC541 U.S. PTO 60/099451 09/08/98

EXPRESS MAIL number EE604837674US, Deposited September 8, 1998,
I hereby certify that this paper or fee is being deposited with the
United States Postal Service "Express Mail Post Office to Addressee"
service under 37 CFR 1.10 on the date indicated above and is addressed
to Box Provisional Application, Assistant Commissioner for Patents,
Washington, D.C. 20231

Dorothy Sikelnik

PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(b)(2).

Docket Number	2557	Type a plus sign (+) inside this box →	+

INVENTOR(s)/APPLICANT(s)

LAST NAME	FIRST NAME	MIDDLE INITIAL	RESIDENCE (CITY AND EITHER STATE OR FOREIGN COUNTRY)
HORNER, JR.	CHARLES	J.	280 River Road, Apt. 75A, Piscataway, NJ 08854
FRANZYSHEN	FRANK	S.	41 Armstrong St., South Bound Brook, NJ 08880
SHERMAN	MURRAY	S.	41 Madison Ave., Apt. 5A, Madison, NJ 07940

TITLE OF THE INVENTION (288 characters max.)

FOAMABLE FACER AND INSULATION BOARDS MADE THEREFROM

CORRESPONDENCE ADDRESS

GAF MATERIALS CORPORATION
Attn: WILLIAM J. DAVIS, ESQ.
LEGAL DEPARTMENT, BLDG. 10
1361 ALPS ROAD
WAYNE, NEW JERSEY 07470

STATE	NEW JERSEY	ZIP CODE	07470	COUNTRY	USA

ENCLOSED APPLICATION PARTS *(check all that apply)*

[X] Specification	*Number of Sheets*	11	☐ Small Entity Statement
☐ Drawing(s)	*Number of Sheets*		☐ Other (specify)

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT *(check one)*

☐ A check or money order is enclosed to cover the filing fees

[X] The Commissioner is hereby authorized to charge filing fees and credit Deposit Account Number **07-0650**

FILING FEE AMOUNT(S): **150**

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

[X] No.

☐ Yes, the name of the U.S. Govenment agency and the Government contract number are:______

Respectfully submitted,

SIGNATURE Marilyn J. Maue

Date SEPTEMBER 8, 1998

TYPED or PRINTED NAME MARILYN J. MAUE

REGISTRATION NO. 18,869
(if appropriate)

TELEPHONE NO. (973) 628-3544

☐ Additional inventors are being named on separately numbered sheets attached hereto.

United States Patent & Trademark Office

Office of Initial Patent Examination – Document Preparation

JC541 U.S. PTO
60/099451
09/08/98

S/N ____________

Unscannable Application paper found during Document Preparation:

Type of Document:

- ☑ Transmittal Letter
- ☐ Small Entity Statement
- ☐ Preliminary Amendment
- ☐ Specification page(s) ____________
- ☐ Claims
- ☐ Abstract
- ☐ Specification, Claims, Abstract (All pages)
- ☐ Oath or Declaration
- ☐ Drawing sheet(s) ________
- ☐ Biotech Listings
- ☐ Computer Listings
- ☐ Non-English Specification
- ☐ Other ________________

Application papers are not suitable for scanning and are not in compliance with 37 CFR 1 because:

- ☑ Legal-size (8 ½" x 14") - All sheets must be either A4 (21 cm x 29.7 cm) or 8-1/2".
- ☐ Too thin - Papers are not strong and durable.
- ☐ Double-sided - Papers may not be printed on both sides
- ☐ Two-Column Specification - Format can not be electronically reproduced
- ☐ Hand-written - Papers are not typewritten or mechanically produced
- ☐ Glossy pages - Papers are not non-shiny
- ☐ Non-white background - Papers are not white, e g photocopies of photographs.

FDN-2557

PROVISIONAL PATENT APPLICATION

FOAMABLE FACER AND INSULATION BOARDS MADE THEREFROM

DESCRIPTION OF THE INVENTION

Rigid polymeric foam insulation laminates have been used for many years by the construction industry. Uses include commercial roof insulation boards utilized under asphaltic built-up roof (BUR) membranes as well as under various single ply membranes such as EPDM rubber, PVC, modified bitumen membranes and the like. Other uses include residential insulation, as sheathing under siding, and as roof insulation under asphalt shingles and concrete tiles.

Such insulation often takes the form of polymeric foamed thermoset material like polyurethane, polyisocyanurate, polyurethane modified polyisocyanurate (often referred to as polyiso) or phenolic resin, applied between two facing sheets.

These insulation boards are generally manufactured on production lines where a liquid prefoamed chemical mixture is mixed and poured on a bottom facer, foaming up to contact a top facer in a constrained rise laminator. The reaction of the chemical mixture is generally exothermic, as polymerization as well as foaming occurs in the laminator. In the case of polyisocyanurate insulation boards, the curing exotherm lasts well into the time such now rigid boards are cut, stacked and warehoused. The exotherm can continue for as long as 4 days and temperatures can reach as high as 300°F.

Requirements for the facers then must include flexibility, high tensile and tear strength and resistance to high temperatures. Facer porosity must be low to prevent chemical bleed through prior to foaming. Alternatively, the facer can be thick enough so that before chemicals can bleed through, foaming occurs. Facers must show good adhesion to the foam insulation, yet be inert to the effects of the chemicals, especially the blowing agents that also behave as solvents. Blowing agents currently in use include chlorofluorocarbons like HCFC-141b and R-22 as well as hydrocarbons like n-pentane, cyclo-pentane and iso-pentane.

One problem that has plagued the polyiso industry has been a phenomenon called "cold temperature delamination". This phenomenon occurs in cold temperature areas where insulation boards coming off the production line cool before they can be "stack cured". In a worst case scenario, the polyiso foam layer closest to the facer cools, quenching the cure reaction and leaving a brittle layer. This can lead to a shearing of this layer and result in the facer pealing off. Often manufacturers will place a layer of corrugated cardboard over the top facer of the top board and under the bottom facer of the bottom board of the stack, to keep the exothermic heat in and prevent delamination. Thus a facer that could insulate and keep some heat in during stack cure would conceivably lessen incidents of cold temperature delamination and eliminate the need for costly cardboard.

After these foamed polymer insulation boards are manufactured, cut and shipped to their final application site, other properties are required by the facer. Now the facer has to be water resistant and somewhat weatherable, since many applications occur outdoors.

They must resist rain, humidity, ultraviolet light and heat. They must be puncture and scuff resistant to survive being nailed down and walked on. They must withstand temperatures up to 500°F from hot asphalt application. They must resist adhesive solvents used in single ply roofing membrane applications, yet adhere well to these adhesives.

Traditionally, facers used in such applications have included asphalt saturated cellulosic felts, fiberglass mats, asphalt emulsion coated fiberglass mats, aluminum foil/Kraft/foil, glass fiber modified cellulosic felts, glass mats onto which polymeric films have been extruded, and glass mats coated with polymeric latex/inorganic binder coatings. All of these have at least one undesirable property. Asphalt containing products are not compatible with PVC single ply roofing membranes. Fiberglass mats suffer too much bleed-through of prefoam chemicals. Aluminum facers reflect heat back into the foam during processing leading to disruption of cell structure and delamination. Foil faced sheathing is costly; also the foil reflects heat back to vinyl siding, causing it to warp. Glass fiber modified cellulosic felts are susceptible to moisture absorption causing board warping when wet. Extrusion or lamination of polymer film to glass mat is costly. Glass mat coated with a polymeric latex/inorganic binder tend to be brittle.

U.S. Patent No. 5,001,005 describes a facing sheet composed of glass fibers and a non-asphaltic binder. The facer contains 60-90% glass fibers which does not allow enough binder to either close the sheet's porosity nor give the sheet strength. U.S. Patent No. 5,102,728 describes a glass mat substrate coated with a polymeric latex blended with an asphalt emulsion. Again, applying

enough coating to reduce the sheet's porosity results in a product that is too costly. In addition, asphalt is not compatible with PVC single ply roof membranes. U.S. Patent No. 5,112,678 disclosed a facer prepared by coating fiberglass mat with a coating that is a polymer latex and an inorganic binder. This product is somewhat brittle and suffers from mild chemical bleed through. U.S. Patent Nos. 5,698,302 and 5,698,304 describe facers where polymer films are laminated or extruded onto fiberglass mat. This approach is costly and often leads to flammable facers since highly filled polymer films do not extrude well.

The facer of this invention has a fibrous mat substrate on which is coated a frothed or foamed 15 to 80 wt.% aqueous emulsion, dispersion or suspension comprising a thixotropic polymer latex binder, one or more surfactants and optionally an inorganic filler to provide a facer composition preferably containing less than 50 wt.% fibers, about 15 to 80 wt.% polymeric latex binder, about 0 to 80 wt.% filler and about 0.5 to 10% of a surfactant. The latex/surfactant coating of the invention is air foamed and coated to a thickness of from about 5 to about 80 mils on the mat. The resulting facia is then dried to provide an uncured or partially cured foamed composition having a thickness of up to 100 mils. Because of the preferred low fiber to binder, ratio, e.g. between 25% to 45% fiber on a weight basis, the present facer is highly flexible and possesses superior dimensional stability upon curing and high tensile strength as well as significantly improved processing properties. The present facer comprising the mat with a foamed upper latex/surfactant surface, can be fed directly to insulation board manufacture where it is employed as at least one facer on the exposed surface of

the foamed thermosetting non-elastomeric core of an insulation board.

The present facer with prefrothed or prefoamed coating can be prepared by initially forming an aqueous mixture of the foamable latex and surfactant, in the absence or in admixture with a filler, incorporating air into the mixture by vigorous mechanical agitation in the absence or presence of a blowing agent to form a foamed composition of reduced density which density can be reduced to as little as 0.15 g/cc. The consistency of the foam is self-sustaining so that it does not penetrate through the mat and is ideally close to the consistency of shaving cream. Prior to frothing, an inorganic filler can be added to the foamable latex to reduce costs and fortify resistance to flammability. Surfactant is added to promote formation of a froth and maintain the foam structure. The foam is then applied as a coating of between about 5 and about 80 mils thickness to a preformed fiber mat of between about 10 to about 20 mils thickness and dried at below cure or crosslinking temperature to provide a liquid permeable foamed, latex coated fiber mat for conversion to a suitable facer member in the insulation board manufacture. Generally the amount of air incorporated into the foamable coating mixture to achieve optimal consistency is between about 5% and about 80% by volume and produces a foam having bubble openings which are permeable to fluids.

A relatively impervious surface on the facer can then be provided by applying a film or laminating a layer of impervious resin or polymer over the frothed surface to provide a trilayered facer member. A top seal coat of a non-foamed latex is suitable for this purpose. Alternatively, a thermoplastic such as polyethylene powder or unexpanded polystyrene beads can be used as a

filler which melts at the drying/curing temperatures to close pores of the pervious coating. However, expandable fillers such as cellulose can also be used for this purpose. Other methods for reducing the porosity of the foam include the use of less air during foaming, the omission or use of less filler in the coating composition, calendering and/or embossing the foamed or frothed surface by contact with a hot roller or platen. Still another method for producing the relatively impervious surface involves forming the foam on the smooth surface of a conventional release material and then contacting the mat with the opposite surface of the foam. A combination of any of the above options can be employed.

The facer of the invention, having a foamed cellular layer, acts as an insulator during the curing operation effected in the insulation board manufacture. This advantage significantly reduces the prior problem of cold temperature delamination. Also, since the facer coating is dried below curing temperature, it is more flexible during insulation board manufacture and, as the facer passes through the insulation laminator to the subsequent stack cure, exothermic conditions effect the cure. Alternatively the foam coated facer can be completely cured before being combined with the insulation foam.

The pressure applied during lamination in the insulation board manufacture is less than that causing 50% reduction in the thickness of the foamed facer coating and insufficient to cause damage or crushing of the mat fibers in the finished insulation board product.

The weight of the present facer can vary from about 40 to about 300 g/sq. meter and the foamed facer sheet can have a thickness up to about 100 mils in the case of

uncrushed foam and up to about 50 mils for a crushed foam surface of the facer.

The fibers of the mat employed in this invention comprise any of the conventional non-cellulosic types and include fibers of glass, polyester, polypropylene, polyester/polyethylene/teraphthalate copolymers, hybrid types such as polyethylene/glass fiber polymers and other conventional non-cellulosic fibers; glass fibers being preferred in the present invention for their resistance to heat generated during the manufacture of insulation boards and flame resistance in the finished product.

The preformed fibrous mats of the invention which are non-asphaltic and non-cellulosic, generally contain a conventional non-elastomeric binder in an amount sufficient to form a self sustaining web and prevent loss of fibers during processing or handling. Such binders include a phenol-, melamine- and/or urea- formaldehyde resin or a mixtures thereof.

Suitable foamable latex binders for the coating composition applied to the fibrous substrate include polymers of acrylic acid/ester, acrylic ester/vinyl acetate, styrene/acrylic ester, ethylene/vinyl chloride and polyurethane, polyisocyanurate, polyvinylidene chloride, polyvinyl alcohol, polyvinyl acetate polyvinyl chloride and synthetic rubbers, e.g. SBS, SBR, neoprene etc., any other thixotropic polymer or mixtures of the foregoing. The foamable polymer binder or binder mixtures are applied to the substrate surface under ambient conditions in the liquid, paste or gel-like form. It may be useful for some purposes demanding tougher facers to employ latexes which can be crosslinked after drying and during curing in lamination process of the insulation board manufacture.

Although not essential in the binder composition of the present invention, incorporation of fillers are preferred for economics and for increased fire retardance properties. Those fillers useful in the coating mixture include conventional inorganic types such as clays, mica, talc, limestone, other stone dusts, gypsum, aluminum silicate (e.g. Ecca Tex 561), aluminum trihydrate, antimony oxide, calcium silicate, calcium sulfate etc.

Surfactants employed in the coating composition are known organic types suitable for foaming latexes such as for example ammonium stearate (STANFAX 320) and the like.

The present latex coating composition may additionally contain a small amount, e.g. less than about 2.5 wt.%, of a conventional thickening agent, for example an acrylic polymer thickener, e.g. RHOPLEX (ASE 95NP and/or 60NP) and the like. Other inert excipients such as a conventional coloring agent, texturizing agent, light refracting agent, reinforcing agent, e.g. CYMEL (303 resin) and blowing agent may also be included in the latex composition; although addition of these additives in a minor amount of less than 2 wt.% is preferred.

The insulation boards for which the present fascia is particularly suited comprises conventional thermosetting or thermoplastic foam cores, such as foamed polyurethane or polyurethane modified polyisocyanurate or phenol-formaldehyde cores disposed between a pair of facer members which are laminated to the core surfaces. Other non-elastomeric foamable chemicals, such as polyvinyl chloride, polystyrene, polyethylene, polypropylene, etc. can also be employed as the board core. Rigid foamed cores of this type are described for example in U. S. Patent 4,351,873, incorporated herein by reference.

As facing for an insulation board in this invention, a roll of the present facer sheet product is passed to insulation board manufacturing where a foam precursor chemical or mixture of chemicals suitable for forming the board core can be poured onto the non-coated fiber surface of the sheet as it is unrolled and fed into the insulation board laminating apparatus. In one embodiment, the present facer sheet coated with core material, i.e. the first facer, is spaced a distance below a second facer sheet in the apparatus, such as a constricted rise laminator, where the assembly is heated and cured. During this operation the core material foams and rises to engage the lower surface of the second facer. The second facer can be of the same or of a different composition than that of this invention. Specifically the second facer sheet may include any of those conventionally employed, such as for example a cellulose or cellulose-glass hybrid felt sheet, perlite, aluminum foil, multilaminated sheets of foil and Kraft, uncoated or coated fiber glass mats; although the second facer sheet of the present invention is preferably one of the present invention with its fibrous non-coated surface facing the fibers of the first sheet . As the insulation foam is spread on the fibrous surface of the first sheet, it enters the laminator where, due to expansion with a blowing agent, it rises to contact the undersurface of the second facer and hardens thereon; thus providing a rigid insulating foam core sandwiched between two facer sheets. The resulting product can then be cut into boards of desired size and shape. The heat generated in the laminator and the subsequent stack of boards is sufficient to effect curing of the non-elastomeric insulation core foam and also the latex foamed or foamable surface of the facia sheet exposed surface.

Curing temperatures in the laminator of up to about 320°F can be employed and heating subsequently continued over a period of up to 4 days by the heat retained during stack curing.

As a second embodiment involving the above operation, the top and bottom positioning of the facer sheets can be reversed so that the facer of this invention is fed and spaced above a conventional facer in a manner such that its non-coated fibrous surface faces the foamable insulating core chemical being coated on a lower facer sheet. This procedure is practiced where one facer is a rigid sheet such as in perlite or particleboard as opposed to the flexible facer of this invention which can be fed to the laminator as a continuous roll. In this case the insulating foamable chemical is surfaced on the rigid member and rises to engage the fibrous surface of the present facer.

The latex foamed surface of the present facer which, due to its comparatively thick latex foam outer surface and low fiber to foam ratio, more efficiently retains heat between the layers of the roll and thus aids significantly in the subsequent laminating operation by a savings in heat energy requirements. Because of this, lamination of the core can be completed at a faster rate. Additionally, retention of heat during curing significantly reduces "cold temperature delamination" in the product, which represents a serious industry problem and is caused by failure of the top layer of insulation to completely cure due to cooler temperatures exposure of product after leaving the laminator. Manufacturers of polyisocyanurate core insulation frequently are obliged to take costly steps to prevent this phenomenon, e.g. by placing heat barriers such as boards on the top and bottom laminates to continue the heat cycle by retaining

internal heat. Superior adhesion of the present facer to the core foam is also evidenced when glass fibers are contacted with the core foam.

The above insulation boards are useful in commercial roof insulation, residential or commercial wall sheathing etc. Depending upon the intended use, the present insulation board has a core thickness which may vary widely, for example between about 0.5 and about 4 inches or more.

In still another embodiment of this invention, it is possible to form the insulation core separately, i.e. absent contact with a facer, and subsequently bond one or more of the present facers to the core using suitable adhesives. In general, the teachings of U.S. Patent 4,351,873 are applicable to the formation of rigid foam cores and adhesion of facer sheets to at least one surface of such cores. Polyurethane or polyisocyanurate are most commonly employed as core materials; although other non-elastomeric, foamable chemicals are also employed. The later includes polyvinyl chloride, polystyrene, the facers and the insulation board products of this invention exhibit resistance to cracking at low temperatures and possess exceptionally superior dimensional stability and flexibility. They also have high flame resistance and tensile strength as opposed to prior facers containing 60-90 wt.% fibers which deleteriously limit the amount of binder resulting in poor strength. As such, the facers of this invention can find additional application as non-foil, non-glare sheathings, as shingle underlayment, separation or barrier sheets and other uses which will become apparent from the foregoing disclosure.

UNT OF DRAWINGS
S ORIGINALLY FILED

United States Patent & Trademark Office

Office of Initial Patent Examination -- Scanning Division

Application deficiencies found during scanning:

1. Application papers are not suitable for scanning and are not in compliance with 37 CFR 1.52 because:
   - ☐ All sheets must be the same size and either A4 (21 cm x 29.7 cm) or 8-1/2"x 11"
     Pages ________________________ do not meet these requirements.
   - ☐ Papers are not flexible, strong, smooth, non-shiny, durable, and white.
   - ☐ Papers are not typewritten or mechanically printed in permanent ink on one side.
   - ☐ Papers contain improper margins. Each sheet must have a left margin of at least 2.5 cm (1") and top, bottom and right margins of at least 2.0 cm (3/4").
   - ☐ Papers contain hand lettering.

2. Drawings are not in compliance and were not scanned because:
   - ☐ The drawings or copy of drawings are not suitable for electronic reproduction.
   - ☐ All drawings sheets are not the same size. Pages must be either A4 (21 cm x 29.7 cm) or 8-1/2" x 11".
   - ☐ Each sheet must include a top and left margin of at least 2.5 cm (1"), a right margin of at least 1.5 cm (9/16") and a bottom margin of at least 1.0 cm (3/8").

3. Page(s)_________________ are not of sufficient clarity, contrast and quality for electronic reproduction.

4. Page(s)_________________ are missing.

5. OTHER: No Declarations